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AUTHOR Hamel, Cheryl J.; And Others
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ABSTRACT

The results of a field test which evaluated the training effectiveness of a new curriculum in the Naval Apprentice Training Program are detailed. The new mathematics curriculum was designed by Memphis State University to teach fundamental mathematical skills to low-aptitude sailors. The goal was to bring such sailors to at least eighth-grade proficiency. Fifty recruits comprised the sample. The curriculum consisted of 13 modules, but sailors were individually diagnosed and prescribed only those sections where deficiencies were noted. Of the 50 subjects, 36 persons required remediation in 1 or 2 areas, 8 needed remediation in 3 or 4 areas, and 6 needed to study 5 or 6 modules. It is concluded the program was successful, with the curriculum requiring an average of 8.5 days to complete. The program was not designed to accommodate the requirements of specific Navy training programs or jobs but rather to parallel the content of the Stanford Diagnostic Mathematics Test, Brown Level. It is recommended that the curriculum be used whenever the goal is to provide sailors with an eighth-grade minimum competency level in mathematics, but to use an existing workbook to teach various prerequisite computational and higher order application skills. (MP)

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TECHNICAL REPORT 135

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FIELD TEST OF A NUMERICAL BASIC SKILLS CURRICULUM

NOVEMBER 1982

FOCUS ON THE TRAINED PERSON

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TRAINING ANALYSIS AND EVALUATION GROUP
ORLANDO FLORIDA 32813

Technical Report 135

FIELD TEST OF A NUMERICAL BASIC SKILLS CURRICULUM

Cheryl J. Hamel
J. Peter Kincaid
Janet Thompson

Training Analysis and Evaluation Group

November 1982

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Alfred F. Smode

ALFRED F. SMODE, Ph.D., Director,
Training Analysis and Evaluation Group

W. L. Maloy

W. L. MALOY, Ed.D.
Deputy Chief of Naval Education and Training for Educational Development and Research and Development

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IM3 E. Marshall, Recruit Training Command (RTC) Code 56, Orlando, was the instructor who conducted the classroom activities. YN3 T. L. Harrington, RTC, Code 56, Orlando, performed the testing duties.

LT Zana Tellis, then Division Officer, Academic Remedial Training, RTC, Code 56, Orlando, and LCDR Fred Jackson, then Director, Technical Training Department, RTC, Code 50, Orlando, coordinated the field test activities.

The project was sponsored by the Chief of Naval Education and Training under the direction of CDR William Losa, Code N-55.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Memphis State University, under the auspices of the Chief of Naval Technical Training, designed a mathematics curriculum to teach fundamental mathematical skills to low aptitude sailors enabling them to attain at least eighth grade proficiency in mathematics. This report presents the results of a field test which evaluated the training effectiveness of the curriculum in the Apprentice Training program at the Recruit Training Command, Orlando. Suggestions for implementing the curriculum are given.

TABLE OF CONTENTS

Section		Page
I	INTRODUCTION	3
	Background	3
	Purpose of this Study	4
II	METHOD	5
	Numerical Skills Curriculum	5
	Tests	5
	Metropolitan Achievement Tests (MAT): Mathematics Survey Test, Intermediate Level	6
	Stanford Diagnostic Mathematics Test (SDMT), Brown Level	6
	Navy Numerical Skills Test	7
	Criterion Tests	7
	Screening Procedure	7
III	RESULTS	9
	Remediation Requirements	9
	Pretest-Posttest Analyses	10
IV	CONCLUSIONS AND RECOMMENDATIONS	13
	Conclusions	13
	Recommendations	14
REFERENCES		15
APPENDIX	Excerpts from the Numerical Skills Curriculum	17

LIST OF TABLES

Table		Page
1	Description of Apprentice Trainees Referred to the Numerical Skills Curriculum	8
2	Number of Students Needing Remediation in Each Instructional Module	10
3	Summary of Test Scores Before and After Mathematics Remediation	11

SECTION I

INTRODUCTION

Improving reading, communication, and mathematics basic skills of enlisted personnel is receiving increased attention in the Navy. The importance of job-related training in basic skills for successful performance in Navy training courses has been underscored (see for example, Baker and Huff, 1981). Currently, there are three Navy programs available to enlisted personnel deficient in basic or prerequisite skills: the Academic Remedial Training (ART) Program designed for recruits, the Navy Campus Functional Skills Program for permanent duty station personnel and personnel awaiting "A" school training, and the Job-Oriented Basic Skills (JOBS) Program for non-school eligible personnel attempting to qualify for "A" school. Combined enrollments for the three programs surpassed 29,000 in FY 81 (Sticht, 1982).

A recent OPNAV instruction[1] directs the Chief of Naval Education and Training (CNET) to define required competency levels for all enlisted training courses and to design and implement training programs to achieve these competency goals.

In the basic skills area, the greatest research emphasis has been placed on remedial reading instruction (e.g., Aiken, Duffy, and Nugent, 1977). The Training Analysis and Evaluation Group (TAEG), working with the Chief of Naval Technical Training (CNTECHTRA), has made contributions in this area (Brown and Kincaid, 1982; Kincaid and Curry, 1979).

Concurrent with this, the Navy has sponsored research on remedial numerical skills instruction. Recent efforts are reported in Brown and Kincaid (1981), Sachar and Baker (1981), and Bowman, Jones, Kaiser, Kincaid, and McDaniel (1981). The present report is a contribution to this area.

BACKGROUND

In most technical training courses, basic mathematical skills are course prerequisites, yet students entering "A" schools often require review and instruction in basic arithmetic, squares and square roots, and conversions (Sachar and Baker, 1981). Students in Basic Electricity and Electronics (BE/E) school often do not meet mathematics requirements in these same areas and are especially deficient in fractions (Baker, 1981).

Studies dealing with the Recruit Training and Apprentice Training environments have identified problems similar to those found in the technical training environment. Graham, Jones, and Kaiser (1980) and Brown and Kincaid (1981) have shown that in Recruit Training and Apprentice Training, 13 to 33 percent of the students have deficiencies in basic numerical skills.

[1]OPNAVINST 1510.11 of 19 August 1982, "Enlisted Fundamental Skills Training."

In response to these deficiencies, the TAEG has been tasked by CNET[2] to participate in the development and evaluation of mathematics basic skills training materials for use in ART and in Apprentice Training. The TAEG, in cooperation with the CNTECHTRA, developed and field tested a remedial mathematics workbook titled Improving Your Navy Numerical Skills (Bowman, et al., 1981). The workbook was designed as a companion document to a remedial reading workbook Improving Your Navy Reading Skills (Kincaid and Curry, 1979). The prominent feature of both workbooks was the Navy-relevant content.

The TAEG recommended that the mathematics workbook be used in Apprentice Training with students who have difficulty with elementary mathematics because the workbook was designed around the numerical skills requirements of that training program. It was also suggested that the workbook was suitable for the ART program since that program does not contain any instruction in elementary mathematics. The workbook was designed to be part of a complete remedial mathematics curriculum developed with standard academic materials.

Concomitant with the evaluation of the workbook, a mathematics curriculum, developed by Memphis State University under the auspices of CNTECHTRA, was designed to teach fundamental mathematical skills to low aptitude sailors enabling them to attain at least "minimal proficiency" in mathematics. The TAEG was tasked by the CNET to field test this curriculum at the Recruit Training Command (RTC), Orlando.[3] The curriculum, based on the Stanford Diagnostic Mathematics Test, contains material from the workbook Improving Your Navy Numerical Skills (Bowman, et al., 1981).

PURPOSE OF THIS STUDY

The purpose of this study was to evaluate the training effectiveness of the Numerical Skills Curriculum in the Apprentice Training program at RTC, Orlando, and to provide suggestions for improvement of the curriculum. Results of the study were intended to contribute to the CNET effort to implement remedial mathematics instruction in the Navy training pipeline.

[2]CNET ltr Code N-53 of 20 December 1978.
[3]CNET ltr Code 022 of 9 September 1981.

SECTION II

METHOD

This section describes the Numerical Skills Curriculum and reports the initial mathematics and language achievement levels of Apprentice trainees who served as subjects in the field test of the curriculum. Descriptions of the tests used to screen students for the program and to evaluate student performance are also presented.

NUMERICAL SKILLS CURRICULUM

The Numerical Skills Curriculum, based on the Stanford Diagnostic Mathematics Test (SDMT), Brown Level (Beatty, Madden, Gardner, and Karlsen, 1976), for grades five through seven, provides remediation in three broad skill areas: Number System and Numeration, Computation, and Applications. Each of these skill areas is represented in a major section of the curriculum and each section is divided into modules. Each of the 13 modules is directed toward a terminal objective. The terminal objectives specify the behavior to be demonstrated by the student, the conditions under which the performance is to occur, and the mastery criterion. Exit performance is assessed by a criterion test for each module.

Terminal objectives are supported by enabling objectives in each module. These objectives focus on skills at the lowest level of specificity. Several activities that can be assigned for remediation are based on the enabling objectives.

To illustrate the format of the curriculum, the enabling objectives, the assignments, and the criterion test for module 3.1 are presented as examples in the appendix. The complete curriculum is presented in a supplement to this report.

The general course goals of the three major sections of the curriculum are described below.

. Number System and Numeration. The student demonstrates an understanding of the whole number system, decimal place value, fractions, decimals, and numerical operations and properties.

. Computation. The student demonstrates an understanding of basic numerical operations of addition, subtraction, multiplication and division involving whole numbers, fractions, decimals, and number sentences.

. Applications. The student demonstrates the ability to solve mathematical word problems, to use tables and graphs for problem solving, and to apply knowledge of geometry and measurement.

TESTS

The following tests were used to assess student performance in the Numerical Skills program.

METROPOLITAN ACHIEVEMENT TESTS (MAT): MATHEMATICS SURVEY TEST, INTERMEDIATE LEVEL. The MAT is a series of tests designed to assess math achievement in kindergarten through the 12th grade (Prescott, Balow, Hogan, and Farr, 1979). The test is standardized on a national representative sample of students to provide a normative reference for the interpretation of scores. The Intermediate Level used in this study, is designed for the grade span of 5.0 through 6.9. However, norms are extrapolated to cover the grade range from the first grade through the 12th grade.

The test contains 50 items and requires about 40 minutes for administration. Items measure mathematical skills in the following areas: numeration, geometry and measurement, problem solving, operations (whole numbers), operations (laws and properties), operations (fractions and decimals), and graphs and statistics.

Besides its use as a screening device for the Numerical Skills program, parallel forms of the test, JS and KS, were used for pre-program and post-program assessment.

STANFORD DIAGNOSTIC MATHEMATICS TEST (SDMT), BROWN LEVEL. This test is designed to measure competence in concepts and skills that represent basic mathematical competence necessary for continued study of mathematics. As a diagnostic instrument, the SDMT focuses on the identification of specific skill deficiencies in more detail than does a general achievement test.

Four levels of the test are available for use with grade 1 through community college. The Brown Level, used in this study, is intended for use with students in grades 6 and 7 and low achieving grade 8 and high school students.

Norms are extrapolated to cover the range from second grade through eighth grade. The Brown Level test contains 117 items and requires 100 to 120 minutes for administration. The three subtests are Number System and Numeration, Computation, and Applications.

The Number System and Numeration subtest requires that an individual demonstrate a knowledge of the number system by counting, reading and interpreting numerals, and ordering numerals. Rational numbers and common fractions are named as parts of a whole. Basic numeral operations and numeral properties are also emphasized in this subtest.

The Computation subtest requires a knowledge of the computational activities of addition, subtraction, multiplication, and division. Computational skills also involve fractions, decimals, and number sentences.

The last subtest, Applications, requires a knowledge of (1) problem solving, (2) reading and interpreting tables and graphs, and (3) geometry and measurement.

The three major sections of the Numerical Skills Curriculum are based on these subtests, and the 13 modules (skill areas) of the curriculum correspond to clusters of individual test items within each subtest. Response

to test items were analyzed to identify each student's deficiencies in particular skill areas and prescribe the necessary remedial modules.

Parallel forms of the SDMT, A and B, were used to provide pre-program and post-program scores for all students in the study. Pass scores for each skill area were based on eighth grade subtest norms.

NAVY NUMERICAL SKILLS TEST. This test was developed for use in conjunction with the remedial mathematics workbook Improving Your Navy Numerical Skills. The first 24 items (Part I) on the test assess basic computational skills and the remaining 26 items of the test (Part II) measure proficiency in applying the skills to Navy-relevant problems.

Two parallel forms of the test, A and B, were used in this study to assess these mathematical abilities before and after participation in the Numerical Skills program. Both forms of the test are contained as an appendix in Bowman, et al. (1981).

The test requires 40 to 50 minutes for administration.

CRITERION TESTS. The Numerical Skills Curriculum contains 13 criterion tests which parallel the format of the SDMT. The purpose of the criterion tests is to determine whether or not the student has achieved mastery in a particular skill area before moving into another module of the curriculum or exiting the program. In this study, a minimum performance level of 80 percent correct responses was specified for each of the criterion tests.

The length of a criterion test is variable depending on the concept/skill being measured. The length ranges from 10 to 15 items per test.

SCREENING PROCEDURE

The Metropolitan Achievement Tests (MAT); Mathematics Survey Test, Intermediate Level was used to screen students for the program. The test was administered to 296 Apprentice trainees awaiting entrance to the Fireman Apprentice Training course. This particular group was chosen because the Fireman course had a large backlog, which made these students available for testing. Within this group, 65 trainees with mathematics achievement levels below eighth grade were identified. Fifteen recruits participated in a pre-pilot test and the remainder comprised the sample for the field test. A summary of the aptitude scores and academic achievement scores of subjects (N = 50) who participated in the field test is provided in table 1.

The group's mean mathematics grade level (MAT) was 6.9, and the mean reading grade level (Gates-MacGinitie Reading Test, MacGinitie, 1978) at the beginning of Recruit Training was 8.7. The scores from the ASVAB, given to all personnel prior to their enlistment in the military, were about one standard deviation below Navy means.

TABLE 1. DESCRIPTION OF APPRENTICE TRAINEES REFERRED TO THE NUMERICAL SKILLS CURRICULUM (N=50)

TEST	MEAN	STANDARD DEVIATION
Metropolitan Achievement Test: Mathematics (Grade Level)	6.9	.7
Gates-MacGinitie Reading Test (Grade Level)	8.7	1.9
Armed Services Vocational Aptitude Battery (ASVAB)		
Word Knowledge (WK)	44.8	7.0
Paragraph Comprehension (PC)	45.7	5.9
Arithmetic Reasoning (AR)	44.3	5.7
Numerical Operations (NO)	48.7	6.6
AFQT*	29.1	11.8

*The formula, AFQT = WK + PC + AR + ½ NO, provides a raw score which is converted to a percentile score.

SECTION III

RESULTS

This section presents the results of the field test of the Numerical Skills program. The results are organized into two parts: (1) analysis of the remediation requirements of the sample and (2) analyses of the results of evaluation tests given to recruits before and after their participation in the Numerical Skills program.

REMEDIATION REQUIREMENTS

Diagnoses of mathematics deficiencies and the corresponding need for remedial instruction were based on the results of the Stanford Diagnostic Mathematics Test (SDMT). Of the 50 students involved in the program, 36 required remediation in only 1 or 2 of the 13 instructional areas that make up the curriculum. Eight students needed remediation in 3 or 4 areas, and six needed remediation in 5 or 6 areas.

To identify which modules were most frequently prescribed for remediation, the numbers of students who received remediation in each of the modules was tabulated. The results are shown in table 2.

The modules of the curriculum prescribed most often were: Rational Numbers and Numeration (39 of 50 students), Addition and Subtraction of Fractions (26 of 50), and Geometry and Measurement (17 of 50). The Numerical Skills instructors assessed particular remediation needs in each of these areas by reviewing which questions each student missed on the SDMT. For almost all students, remediation needs in the first two modules involved understanding fractions. (Most questions involving decimals were answered correctly.) In the third area, Geometry and Measurement, remediation primarily involved metric units and conversions.

The other 10 modules of the curriculum were either never prescribed or were prescribed for less than 15 percent of the students in the sample. Included in this group were the Problem Solving module and the Tables/Graphs module. Although test items from these modules involved application of mathematical concepts, the problems were solved easily.

The data suggest that most students who entered the Numerical Skills program required instruction in only a small portion of the total curriculum and that the same instructional modules were prescribed to most students.

The Navy Numerical Skills Test, designed to measure mathematics skills specific to Navy life, was not used as a diagnostic tool in this study; however, the test scores of the group were analyzed to determine general deficiencies in mathematical areas relevant to the Navy. Scores on the two parts of the Navy Numerical Skills pretest were analyzed separately. The mean score on Part I (Basic Numerical Skills) was 97.9 percent and the mean score on Part II (Numerical Skills in the Navy) was 58.4 percent. These scores indicated that students were deficient in <u>applying</u> mathematical skills to Navy-relevant problems, but were not deficient in the skills involved in basic numerical operations.

TABLE 2. NUMBER OF STUDENTS (FROM AN N OF 50) NEEDING REMEDIATION IN EACH INSTRUCTIONAL MODULE*

Number System and Numeration Modules**	39
Whole Numbers and Decimal Place Value	2
Rational Numbers and Numeration***	39
Operations and Properties	6
Computation Modules**	34
Addition of Whole Numbers	0
Subtraction of Whole Numbers	7
Multiplication of Whole Numbers	7
Division of Whole Numbers	7
Addition and Subtraction of Fractions	26
Decimals	2
Number Sentences	2
Applications Modules**	18
Problem Solving	0
Interpreting Tables/Graphs	3
Geometry and Measurement	17

*Students' diagnosed deficiencies are based on the results of the Stanford Diagnostic Mathematics Test, Brown Level.
**A student may have needed remediation in more than one instructional module.
***This section largely involves reading and interpreting fractions.

PRETEST-POSTTEST ANALYSES

Students remained in the Numerical Skills program an average of 8.5 days. The range was 3 to 28 days.

Performance was evaluated in terms of mean change in individual test scores. The results are reported in table 3.

Table 3 indicates that the group made significant gains in mathematics achievement after Numerical Skills training. The mathematics grade level (MGL) as measured by the MAT increased from 6.9 to 10.4,[3] and performance on the Navy Numerical Skills Test increased by 9.3 percent.

[3]It should be noted that subjects were chosen for the program because they had a low MGL. The MGL increase shown by the group after training may be partially due to a statistical phenomenon known as "regression to the mean." This means that, typically, people who receive extreme test scores on some characteristic, when retested, score closer to the mean of the entire group.

TABLE 3. SUMMARY OF TEST SCORES BEFORE AND AFTER MATHEMATICS REMEDIATION

TEST	STUDENTS N	PRETEST MEAN	POSTTEST MEAN	MEAN CHANGE
Metropolitan Achievement Tests: Mathematics (Grade Level)	50	6.9	10.4	3.5*
Navy Numerical Skills Test (Percent Correct)	50	76.0	85.3	9.3*
Stanford Diagnostic Mathematics Test (Percent Correct)				
Number System and Numeration	39	70.2	85.9	15.7*
Computation	34	85.2	95.2	10.0*
Applications	18	80.2	89.1	8.9*

*The mean change is statistically significant ($p<.01$).

For the purposes of summarizing the SDMT results, raw scores were converted to percent correct scores. (Grade levels could not be reported because conversion tables in the SDMT manual do not report grade level equivalents for raw scores beyond eighth grade.) For each subtest of the SDMT, scores before and after remediation were analyzed. The mean gain was 15.7 percent on the Number System and Numeration subtest, 10 percent on the Computation subtest, and 8.9 percent on the Applications subtest.

Although many students received remediation in only one or two modules of the curriculum, gains in these skill areas alone do not wholely account for the gain score observed on a subtest. When doing problems in one module, students received practice and review beneficial to related skill areas. Gain scores on the subtests reflect general improvement in many areas of the curriculum.

Student t-tests for matched pairs were computed to determine the significance of the mean change in test performance (from pretest to posttest) for all tests used in the study. The obtained t-values ranged from 7.87 to 12.60, and all were significant ($p<.01$). These tests indicate substantial gains in basic mathematical performance as a result of the remediation program.

Ten recruits in the sample were graduates of the ART program in Orlando. Although their scores were included in all statistical analyses presented in this study, the ART group's performance and their remediation requirements were analyzed separately to determine if these measures differed from the entire group.

The ART group spent an average of 8.8 days in the program. Five subjects required remediation in one or two areas of the curriculum and the number of areas required by the remaining ART subjects ranged from three to six.

After participation in the Numerical Skills program, the mean MGL of the ART group changed from 6.9 to 11.0 and their mean Navy Numerical Skills Test score changed from 76.6 to 86.4 percent. These ART scores can be compared with the entire group's scores shown in table 3. These change scores indicate that the performance of the ART graduates and their remediation requirements did not differ from that of the sample as a whole.

SECTION IV

CONCLUSIONS AND RECOMMENDATIONS

This section discusses the results of the curriculum evaluation and presents recommendations for curriculum implementation.

CONCLUSIONS

The Numerical Skills program was designed to teach sailors the mathematical skills necessary to meet academically defined minimum competency requirements and it accomplished this goal. Navy Apprentice trainees with mathematics achievement levels below eighth grade were identified, their mathematical skill deficiencies were diagnosed and remediated, and they accomplished the desired skill levels.

The curriculum required an average of 8.5 days to complete, but this time can be reduced by retaining only those tests needed for assessment of remediation requirements. The Navy Numerical Skills Test is not needed, since it served only to gather additional information in the study. Posttests with the Stanford Diagnostic Mathematics Tests are also not required because the curriculum's criterion tests assess proficiency prior to exit from modules or from the program.

The Numerical Skills Curriculum was not designed to accommodate the requirements of specific Navy training programs or Navy jobs. Rather, the curriculum was constructed to parallel the content of the Stanford Diagnostic Mathematics Test, Brown Level. Thus, the curriculum improves the academic abilities of low-aptitude enlisted personnel by helping them to master basic mathematical skills. These skills will enable sailors to solve higher-order mathematical problems encountered in their personal lives (e.g., personal finance) as well as on the job.

The curriculum is suitable for the Academic Remedial Training program or it can be used as a remedial module in the Apprentice Training program. However, if a remedial mathematics program is considered necessary for Apprentice Training, the remedial mathematics workbook Improving Your Navy Numerical Skills (Bowman, et al., 1981) should be considered as an alternative to the complete Numerical Skills Curriculum. The workbook is designed to teach elementary mathematical skills with a focus on those skills appropriate to the Apprentice Training program and to general detail job performance in the Fleet. The workbook teaches more computational skills than the curriculum, and also stresses application of those skills to Navy-relevant problems. Furthermore, the workbook requires an average of 2½ days of supervised study, and two forms of the Navy Numerical Skills Test are available for pretesting and posttesting.

Considering the advantages and disadvantages of the workbook and the curriculum, the workbook appears to be the better choice for Apprentice Training because two goals can be accomplished. That is, the workbook can teach basic numerical skills and the numerical skills specified as prerequisites for Apprentice Training and job performance.

Before the Numerical Skills Curriculum is considered as an addition to the ART program, an analysis should be conducted to determine the extent of the need for the program and the cost of the program in Recruit Training.

Measures providing useful information would concern retention and job performance. These measures were unavailable during the time period of the present study.

RECOMMENDATIONS

The following recommendations are based on findings from the field test of the Numerical Skills Curriculum:

- Use the curriculum whenever the goal is to provide sailors an eighth grade minimum competency level in mathematics. In each application, use of the curriculum should be based on needs and cost-benefit analyses.

- Use the workbook Improving Your Navy Numerical Skills and the Navy Numerical Skills Test in Apprentice Training rather than the Numerical Skills Curriculum to teach sailors various prerequisite computational skills and higher-order mathematics application skills relevant to Apprentice Training.

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APPENDIX

EXCERPTS FROM THE NUMERICAL SKILLS CURRICULUM

PROBLEM SOLVING
Solution Models

ENABLING OBJECTIVE: Given word problems involving one step or two steps, the student will be able to identify the appropriate number sentence to solve the problems with an accuracy of at least 80 percent.

INSTRUCTIONS: Complete all of the activities listed below that have a date written in the space under "Date Assigned." The activities must be done in the order assigned by your instructor. If no order is assigned, you may do the activities in any order you choose.

The activities require only pencil and paper except where noted. Answers to the activity items should be recorded on worksheets in your notebook. Your instructor will give directions for scoring and recording results on each activity. See your instructor if you have any questions about your work.

Material			Date Assigned	Date Completed	Score	Instructor's Initials
18 Arithmetic Skills Workbook						
Unit 3	Page 13	Problem 1-5	_____	_____	_____	_____
4	16	1-5	_____	_____	_____	_____
5	18	1-5	_____	_____	_____	_____
6	22-23	1-5	_____	_____	_____	_____
7	25	1-5	_____	_____	_____	_____
8	28	1-5	_____	_____	_____	_____
Preparation for High School Equivalency in Mathematics - Book 5						
22 Exercise 2	Page 9	Problem A-B	_____	_____	_____	_____
3	10	A-B	_____	_____	_____	_____

23

Material	Date Assigned	Date Completed	Score	Instructor's Initials
Preparation for High School Equivalency in Mathematics - Book 5 (continued)				
Exercise 4, Page 13, Problem A-B				
Exercise 5, Page 14, Problem A-B				
Steps To Mathematics - Book 5				
Lesson 16, Page 16, Problem 1-8				
Lesson 20, Page 20, Problem 1-6				
Lesson 27, Page 27, Problem 1-5				
Lesson 30, Page 30, Problem 1-6				
Lesson 36, Page 36, Problem 1-6				
Lesson 43, Page 43, Problem 1-8				
Improving Your Navy Numerical Skills				
Topic: Basic Pay; Lesson 2; Page 99-100; Exercise C: 1-6				
Topic: Basic Pay; Lesson 3; Page 101-102; Exercise C: 1-6				
Topic: Basic Pay; Lesson 4; Page 103-104; Exercise C: 1-5				
Topic: Budget Preparation; Lesson 2; Page 122; Exercise B: 1-6				

PROBLEM SOLVING
Two-Step Problems

ENABLING OBJECTIVE: Given two-step word problems, the student will be able to solve the problems with an accuracy of at least 80 percent.

INSTRUCTIONS: Complete all of the activities listed below that have a date written in the space under "Date Assigned." The activities must be done in the order assigned by your instructor. If no order is assigned, you may do the activities in any order you choose.

The activities require only pencil and paper except where noted. Answers to the activity items should be recorded on worksheets in your notebook. Your instructor will give directions for scoring and recording results on each activity. See your instructor if you have any questions about your work.

Material			Date Assigned	Date Completed	Score	Instructor's Initials
Steps To Mathematics - Book 2						
Lesson 39	Page 39	Problem 1-8				
46	46	1-8				
48	48	1-8				
50	50	1-6				
57	57	1-6				
Arithmetic Skills Workbook						
Unit 84	Page 258-259	Problem 1-2				
85	261	1				
86	266	1-2				
87	266-269	1-2				

Material	Date Assigned	Date Completed	Score	Instructor's Initials
Improving Your Navy Numerical Skills				
Topic: Measuring Temperature — Lesson: 2 — Page: 84 — Exercise: C: 1-5	_____	_____	_____	_____

21

PROBLEM SOLVING
Rate Problems

ENABLING OBJECTIVE: Given word problems involving ratios, the student will be able to solve rate problems involving time, time and distance, and money with an accuracy of at least 80 percent.

INSTRUCTIONS: Complete all of the activities listed below that have a date written in the space under "Date Assigned." The activities must be done in the order assigned by your instructor. If no order is assigned, you may do the activities in any order you choose.

The activities require only pencil and paper except where noted. Answers to the activity items should be recorded on worksheets in your notebook. Your instructor will give directions for scoring and recording results on each activity. See your instructor if you have any questions about your work.

Material				Date Assigned	Date Completed	Score	Instructor's Initials
22							
Arithmetic Skills Workbook							
Unit 40	Page 127	Problem 1-5		_____	_____	_____	_____
Review	128	21-26		_____	_____	_____	_____
Basic Essentials of Mathematics - Part 2							
Unit 4	Page 96	Problem 1-20		_____	_____	_____	_____
Preparation for High School Equivalency in Mathematics - Book 5							
30 Exercise 41	Page 86	Problem A-5		_____	_____	_____	_____

Material	Date Assigned	Date Completed	Score	Instructor's Initials
Arithmetic Module Series: Complete, Non-Programmed				
Module 4 Unit 6 Page 289-304 Problem (Exercises)	_____	_____	_____	_____
Improving Your Navy Numerical Skills				
Topic: Military Time Lesson 1 Page 51-53 Problem C: 1,2,4	_____	_____	_____	_____

23

PROBLEM SOLVING
Missing Data

ENABLING OBJECTIVE: Given word problems with missing data, the student will be able to identify the additional information needed to solve the problems with an accuracy of at least 80 percent.

INSTRUCTIONS: Complete all of the activities listed below that have a date written in the space under "Date Assigned." The activities must be done in the order assigned by your instructor. If no order is assigned, you may do the activities in any order you choose.

The activities require only pencil and paper except where noted. Answers to the activity items should be recorded on worksheets in your notebook. Your instructor will give directions for scoring and recording results on each activity. See your instructor if you have any questions about your work.

Material		Date Assigned	Date Completed	Score	Instructor's Initials
Prescription 3.14: Problem Solving - Missing Data					
Worksheet 1	Problem 1-7	_____	_____	_____	_____
2	1-7	_____	_____	_____	_____
3	1-4	_____	_____	_____	_____
4	1-3	_____	_____	_____	_____

CRITERION TEST 3.1

PROBLEM SOLVING

Directions: Read each question carefully. Choose the best answer and mark the appropriate choice on the answer sheet.

EXAMPLE:

Joe bought 5 gallons of gasoline on Monday and 6 gallons on Wednesday. How many gallons of gasoline did he buy on the two days?

a. 10 b. 11 c. 12 d. 8

a	b	c	d
0	●	0	0

1. Jeff had $4 in money. He mowed a yard to earn $8 more. Which number sentence would you use to find out how many dollars he had in all?

   a. $12 - ☐ = $4

   b. $4 + ☐ = $8

   c. $4 + $8 = ☐

   d. $12 - $4 = ☐

2. Vera rode her bicycle 5 miles in the morning and 7 miles in the afternoon. Which number sentence would you use to find the number of miles that she rode in the morning and afternoon?

   a. 12 - ☐ = 5

   b. 5 + 7 = ☐

   c. 12 - ☐ = 7

   d. 5 + ☐ = 7

3. James has a grocery store game card with 4 columns for stamps. Each column has places for 6 stamps. Which number sentence would you use to show the number of stamps needed to fill the card?

   a. 6 + 4 = ☐

   b. 6 - 4 = ☐

   c. 6 ÷ 4 = ☐

   d. 4 x 6 = ☐

4. A club forms teams to play two kinds of games. One game has 4 teams with 4 members on each team. The other game has 2 teams with 5 members on each team. Which number sentence would you use to find the number of members on all teams?

   a. $(4 + 4) + (2 + 5) = \square$

   b. $(4 \times 4) + (2 \times 5) = \square$

   c. $(4 \times 5) + (4 \times 2) = \square$

   d. $(4 + 5) \times (4 + 2) = \square$

5. Mary buys a bag of candy that costs 39¢. She pays for it with 5 dimes. How much change should she receive?

   a. 11¢

   b. 21¢

   c. 34¢

   d. 89¢

6. Bill pays for a coloring pencil that costs 57¢. If he pays for it with 3 quarters, how much change should he receive?

   a. 8¢

   b. 43¢

   c. 54¢

   d. 18¢

7. Jean jogs 3 miles each day for 5 days during the week. She jogs 6 miles on one day during the weekend. How many miles does she jog during the six days?

   a. 21 miles

   b. 18 miles

   c. 33 miles

   d. 14 miles

8. One brand of soap cost 32 cents a bar. Another brand costs 28 cents a bar. Jim buys 4 bars of the cheaper brand of soap. How much did he save?

   a. 61¢

   b. 16¢

   c. 8¢

   d. 4¢

9. It takes 3 people working 9 hours to pick up the trash from a stadium parking lot. How long would it take one person to do the job working at the same pace?

   a. 3 hours

   b. 9 hours

   c. 12 hours

   d. 27 hours

10. Paul can drive 5 miles in 6 minutes. At the same speed, how many miles miles can he drive in 18 minutes?

    a. 18 miles

    b. 90 miles

    c. 15 miles

    d. 10 miles

11. A 6-ounce glass of milk costs 30¢. At the same cost per ounce, how much would you pay for 12 ounces?

    a. 60¢

    b. $1.20

    c. 72¢

    d. $3.60

12. It takes Carlene 2 hours to drive to the beach. What else do you have to know to figure out if she arrives by 11:00 a.m.?

    a. The number of miles to the beach

    b. The speed that she drove

    c. The kind of car she was driving

    d. The time when she left

13. Bob earned $20.00 for painting the walls in a room. What else do you have to know to figure out his hourly rate of pay?

    a. How large the room was

    b. How many hours he worked

    c. How much paint he used

    d. How the paint was applied

14. Sarah has worked 15 problems on her math homework assignment. What else do you have to know to figure out how many problems are left to be worked?

    a. How long it took to work the problems

    b. The kind of problems in the assignment

    c. The number of problems in the assignment

    d. How hard the problems are to work

15. You pay for 5 gallons of gasoline that you buy for your car. What else do you have to know to figure out how much you paid for each gallon of gasoline?

    a. The total cost of the gasoline purchase

    b. The kind of car

    c. The car's fuel efficiency rating

    d. The capacity of the car's gas tank

Technical Report 135

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